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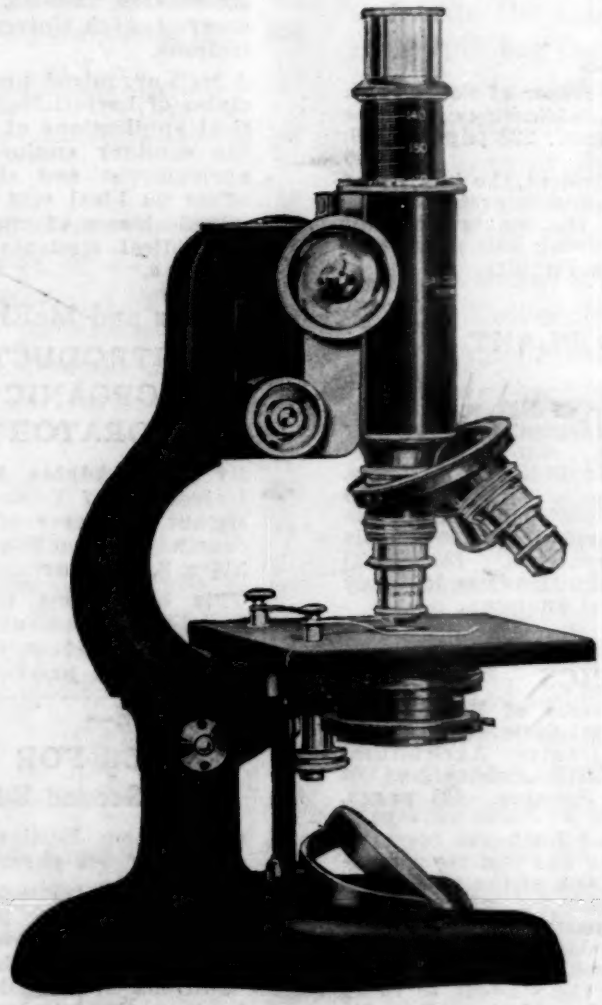

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THE PLACE OF PUBLIC HEALTH IN A UNIVERSITY

PUBLIC health is distinctly a member of the younger generation in the academic sisterhood. It was only in 1901 that the committee on teaching of hygiene and granting of diplomas of doctor of public health, of the American Public Health Association, made its first report, with W. T. Sedgwick as chairman and Wyatt Johnston, of Montreal, as secretary;[1] and in the preceding academic year (1898–1900) Johnston had offered the first course for the diploma in public health at McGill. It is true that long before this time Sedgwick at the Massachusetts Institute of Technology had begun to turn out men who were to lead in the upbuilding of sanitary science on this continent[2] but they were given degrees as biologists or engineers—not special degrees in public health.

It is only during the past fifteen years that the development of facilities for higher education in the field of public health has become an active and a general one. In 1904 Toronto followed McGill in establishing a course for the diploma of public health. In 1906 the University of Pennsylvania, for the first time in the United States, offered courses leading to special degrees and certificates in public health, but no such degree was actually awarded there until 1912. The Harvard Medical School has apparently the honor of conferring the first degree of doctor of public health in 1911.[3] In this same year the name of Sedgwick's department was changed from "biology" to "biology and public health." In September, 1913, the Harvard-Technology School for Health Officers, which had so brilliant and significant a career, was opened. In 1918 Yale granted its first certificate of public health. In 1920 the School of Hygiene was established at Johns Hopkins and two years later a similar institution was set up at Harvard. By 1924, the committee on standardization of public health training of the American Public Health Association could list nineteen colleges and universities as giving a total of ninety-eight advanced degrees in public health.

It is natural that the question of the proper place of public health in the scheme of university organization should still remain in large measure an open

[1] Papers and Reports, American Public Health Association, Buffalo meeting, 1901. Vol. XXVII, p. 87.

[2] Such pioneers as Allen Hazen and E. O. Jordan graduated in 1888; G. C. Whipple in 1899; G. N. Calkins and G. W. Fuller in 1890.

[3] Rosenau, M. J., Bulletin 126, U. S. Public Health Service, 1922.

one. In particular, there is a broad difference in policy between universities like Harvard and Johns Hopkins which are developing public health in separate and independent schools, cognate with the schools of medicine and law, and those other institutions which are working out their public health programs in more intimate correlation with medical schools and graduate schools.

There are very obvious advantages in the first plan where financial resources can be found to carry it out on an adequate scale. Particularly in the earlier stages of development along a new educational line, it is desirable that the way should be blazed by institutions which are dedicated to a particular purpose and untrammeled by any other considerations than their primary one; and a certain number of independently organized institutes of hygiene in the German sense will always form an essential part of our national educational scheme. On the other hand, there are also certain distinct and essential advantages in the alternative plan of developing public health work in intimate contact with medical and graduate departments. The purpose of the present articles is to outline, very briefly, some of these advantages, as they have become manifest in the first ten years of the development of public health at Yale.

The Anna M. R. Lauder Department of Public Health was constituted in 1915 as one of the eight fundamental divisions of the Yale School of Medicine (anatomy, physiology and physiological chemistry, bacteriology and pathology, pharmacology, medicine, surgery, pediatrics, obstetrics and gynecology and public health—to which is to be added psychiatry during the coming year). It has, however, its independent endowment of $500,000, given to the university for this specific purpose, in memory of the late Mrs. George Lauder, whose name the department bears. Its first primary function, the development of public health as a medical school discipline, is thus carried on from inside the school and on the basis of a full recognition of public health as an essential element in the training of every physician. The second function of the department, the development of advanced courses for the post-graduate training of specialists in the field of public health, is carried out through the machinery of the Yale Graduate School, in which bacteriology, pathology and public health are united to form one of the twenty-seven departments which make up its organization.

There are of course two aspects of the relation between a department of public health on the one hand and the rest of the university on the other. We may properly ask what the department gets from the rest of the university organization and, next, what it gives in return.

The first question is very easy to answer. It gets the two things which any educational enterprise needs, teachers and students. Where a school of public health is set up as a separate entity it must have—if we may judge by what has happened in institutions of this type—its own independent departments of bacteriology, of chemistry, of parasitology, of physiology, sometimes even of sanitary engineering, duplicating those of the medical school or of other university schools. At Yale we use our specific public health endowment for teaching the principles of public health, public health administration and vital statistics, with the natural subdivisions of these subjects. For all the other disciplines which form an essential part of public health training we turn to the existing university departments in these respective fields. The faculty of the Anna M. R. Lauder Department of Public Health is a small one as it appears on the budgets of the university, but the actual teaching staff includes Winternitz in pathology, Rettger in sanitary bacteriology, Smith in immunology, Mendel in physiological chemistry, Harrison and his staff in zoology, Suttie in sanitary engineering, Gesell in child hygiene, Blake in medicine, Park in pediatrics. We secure a type of teaching in these various fields that only a heavily endowed school of public health could, by itself, attain, and we believe that there is a certain real advantage in the fact that the various sciences ancillary to public health are taught by men who are interested in them primarily as fundamental disciplines rather than in their application to the administrative health field. The applications and the practical administrative viewpoint, it is our own task to give; and this is by no means difficult if the principles and the spirit of the basic sciences have once been effectively instilled.

The close interrelation with other departments of the university helps the work in public health in another very substantial way by the opportunity which it offers for contacts with desirable potential students. It is an obvious fact to all who are familiar with the public health movement of this country as a whole that the condition which is holding us back at every turn is lack of personnel. The general public has awakened to the importance of the public health program. Official agencies and voluntary foundations in the public health field are ready to spend money, ready to call men and women to opportunities of useful and stimulating and well-remunerated service; but the men and women are not here. Above all, we need young graduates in medicine to enter the field of public health. Our public health schools are crowded with Czechs and South Americans; they have a fair supply of non-medical candidates ready to specialize along laboratory lines; they have too many physicians

of forty and over who are turning to public health after retiring from the army or navy or after failing in private practice. None of our schools of public health has the quota which it deserves of young able medical graduates, looking from the first toward public health administration as a life career. That it is a life career which might to advantage absorb 5 per cent. of our young graduates in medicine and give them a living better than the average in private practice, I am quite convinced; but it is only in the medical school that the new meanings of public health and the tempting opportunities which it provides can be brought to the attention of the men our states and cities so much need. For this reason, among others, I believe that an intimate contact between a public health department and the medical school is a matter of first-rate importance. We can already see at Yale the beginning of a new attitude and are already enlisting a few young medical men of high grade for the profession of preventive medicine.

The main argument for constituting the work in public health as an integral department of a medical school is not, however, that the medical school may serve as a recruiting ground for medical officers of health. The vital question here is, not what the medical school does for the department of public health but what the department of public health means to the medical school. For the past twenty years medical orators have revelled in the elaboration of the theme of preventive medicine; and it is indeed a fact that the progress of science and of social organization demands a fundamental realignment in the entire attitude of the physician toward his patient and toward the community. It is quite certain that the doctor of the future must be a family adviser on hygiene and sanitation quite as much as an ameliorative agent in respect to evils already largely consummated. It is very probable, too, that a large proportion of the doctors of the future will not only be doing a new kind of work but doing it in a new way, as parts of an organized community health service. Yet, in face of these profound tendencies, which can only be guided wisely by the intelligent and unselfish leadership of the medical profession, the bulk of that profession stands unconscious of what is going on. The primary cause for this situation lies in the medical school; and we at Yale have taken as one of the cornerstones of the special contribution we are seeking to make to medical education the development of the idea of preventive medicine, not as a form of words but as a vital conception in the student's mind.

Such an objective can not in any adequate measure be attained by the unaided efforts of the department of hygiene. It is a task for the whole faculty and at Yale we have a group of relatively young men on our staff who are one and all animated with this modern spirit, so that the student imbibes the preventive viewpoint in every course which he takes, from pathology to pediatrics. We are planning to correlate and focus all this instruction by an interdepartmental committee on preventive medicine; and a course in principles of public health given in the first half of the fourth year summarizes the main problems which are involved. We have ninety hours for this course, forty-five for lectures, fifteen for discussion and thirty for field work and, while the course includes such facts about water supply and waste disposal and ventilation as the average physician needs to know, its chief aim is to review the relations to the community of all that the student has learned in his three years and to show him the part that he, as a physician, must be prepared to play in the campaigns against infant mortality, tuberculosis and venereal disease and in the development of standards of personal hygiene in the home and in the factory. The attitude of our medical students has fundamentally changed during the past five years. This change is due to a new attitude on the part of the whole faculty of the school; but such a program can best be organized with a department of public health which is an integral part of the medical school as its coordinating center. It is of some interest to note that two recent graduates of the Yale School of Medicine, with no special public health training other than that received in their medical course, have become full-time city health officers and are filling their positions with remarkable success considering their lack of specific preparation.

We may turn next, and more briefly, to the service which a department of public health may render to the graduate school of which it forms a part, so far as the training of specialists in the public health field is concerned. In the years 1917–1918 and 1918–1919 the certificate of public health was conferred at Yale by joint cooperation between the medical school and the scientific school. Since 1919, the granting of advanced degrees in this field has been a part of the work of the department of bacteriology, pathology and public health of the graduate school. The public health subdivision of this department between 1918 and 1925 has presented eighteen candidates for the C. P. H., ten for the Ph.D. and four for the Dr.P.H. The certificate in public health—equivalent to the M.S. degree—is a one-year course, open to college graduates or to students who have completed the first two years of work in an approved medical school. It involves basic courses in principles of public health, public health administration, public health bacteriology, immunology, elements of

sanitary engineering and vital statistics, with elective work and a thesis. Our students have specialized as a rule either along bacteriological or statistical or sociological or administrative lines and in each one of these fields the cooperation of the other departments of the university has proved of incalculable value. We have made a special effort to fill the very real need for both men and women who can combine training in public health with training in sociology and economics to serve as directors of anti-tuberculosis societies and other voluntary agencies where the medical degree is by no means necessary for success; and bacteriologists with only the bachelor's degree and the C. P. H. have proved well qualified for good positions in state and city laboratories and universities. Two such men now hold positions as assistant professors in institutions of high standing.

Our Ph.D. students are in the main specializing either in bacteriology or statistics and are preparing for directorships of state and city laboratories or for university teaching positions. The combination of public health and home economics is, I believe, one that is likely to prove a peculiarly valuable one for women desiring to pursue a professorial career in the future.

For official administrative health work the C. P. H. (with appropriate specialization in health administration) may be taken by a medical graduate; but the doctorate in public health is the degree specially designed for this end. It is normally a two years' course, open only to graduates in medicine, with a rather full curriculum and special provision for practical field work with the Connecticut State Department of Health, the New Haven City Department of Health or some similar agency. If desired the candidate for this degree may specialize in industrial hygiene or in school hygiene, in both of which fields the opportunities offered through other departments of the university are of inestimable value.

The medical school and the graduate school are obviously the closest points of contact for a department of public health; but they are by no means the only points at which such a department touches the life of the university. The public health staff offers a course which forms a vital part of the program of the Yale School of Nursing and it is hoped in the near future to develop in the graduate department of bacteriology, pathology and public health a special program leading to the M.S. degree designed particularly for holders of the degree of bachelor of nursing, a program which will depend on the university departments of social science and education for a considerable portion of its work.

In Yale College the public health staff cooperates with the director of university health in giving a brief elective course on personal and public hygiene, the community aspects of which are of real value for students who may later enter public life. In one city in Connecticut the local health department has been reorganized by a mayor who became interested in the subject through taking this course a few years before. Students from the scientific school occasionally take our courses in industrial hygiene; and a number of very good men from the school of religion have taken the principles of public health as a part of their preparation for community service. Finally, the department of public health has been constantly and closely affiliated with the department of university health and the professor of public health is the chairman of the board which directs the general policies of health supervision of the student body.

It seems, from our experience at Yale, that public health has a real place as one of the fundamental disciplines in a university program. Organized in intimate contact with medical school and graduate school a department of public health may, with a modest endowment, offer graduate courses leading to the advanced degrees which qualify for professional service in this field. It may at the same time serve what is perhaps an even more essential service by becoming a permeating and controlling influence in the training of practitioners of medicine, on whose intelligent cooperation the progress of the public health movement so markedly depends. It may touch such widely separated schools as those of nursing, of religion, of social science, of education, of engineering, with glimpses of a field of human activity which is coming to play a significant part in every phase of modern social life.

C.-E. A. WINSLOW

YALE SCHOOL OF MEDICINE

DATE OF CHANNEL TRENCHING (ARROYO CUTTING) IN THE ARID SOUTHWEST[1]

INTRODUCTION

NEARLY all streams in southwestern United States flow between vertical banks of alluvium that vary in height from ten to as much as one hundred feet. Although subject to great floods, these streams no longer overflow their banks, nor build up their adjacent flood-plains. Floods merely deepen and widen the channels (arroyos) which continually grow headward into the undissected valley floors of headwater valleys and tributaries. The details of this process of dissection (channel trenching) have been elabo-

[1] Published by permission of the director of the United States Geological Survey.

rately described by Rich and named by Gregory the "Recent epicycle of erosion."

It is evident to all observers that the formation of the channel trenches is recent as early settlers in the region can remember the time when many of these valley flood plains were intact and the floods spread widely. At that time, meadows, belts of cottonwood or willow trees, and even swamps characterized the floors of valleys that now support only scattered sage, greasewood or mesquite.

The formation of the arroyos has had a large effect on the distribution of vegetation, and on the use of the valley floors for farming and grazing. The subject, therefore, is of interest to a number of groups, including geologists, botanists, engineers, agriculturalists and grazing experts. Notable changes in population, including the abandonment of villages, have occurred and therefore the cutting of the arroyos is an outstanding event of interest to historians.

It is not, however, the purpose of this paper to discuss the origin of the arroyos but to put in compact and usable form the existing information as to the dates when this process of erosion began. Since each arroyo is lengthened from the mouth headward its formation is spread over a considerable time, which is generally measured in years. Details of the process have been recorded in only a few instances, and the more or less hazy recollections of early settlers are the only source of information regarding some streams. In the accounts of travelers, in the notes of early land surveys and in other local records there are many valuable historical data that as yet are largely unused in a systematic way. With the passage of years such information becomes more difficult to obtain, and it is hoped that the notes presented herewith will stimulate the gathering of more complete data on the time of stream trenching in the arid southwest. In an ideal presentation the material would be assembled by drainage basins. The existing material is, however, too fragmentary to be assembled in this fashion and is here presented in large poorly defined areas.

SOUTHERN COLORADO AND NORTHERN NEW MEXICO

Duce[2] has described the formation of arroyos (channel trenches) in southern Colorado. The pioneer settlers found the bottom land low and rounded, with no suggestion of an arroyo in the center. He gives various types of evidence that the arroyos are recently formed and sets the time as since the early government surveys of 1860 and 1870 and since the settlement of the country—that is, since 1860–65 in southeastern Colorado and since 1870–80 in southwestern Colorado.

According to the local inhabitants, the present channel trench of the Rio Puerco, a tributary of the Rio Grande in New Mexico, was cut in the late 80's. The flood waters are confined between banks and no longer spread widely, so that they are not easily diverted for irrigation. Subsequent to this entrenchment the towns of San Ignacio, San Fernando y Blas and San Francisco, located on the river, have been abandoned.[3] The natural hay fields of the area have largely disappeared. However, above Cabezon, where Simpson[4] crossed the river in 1849, there was at that time a trench, for he states that the channel was one hundred feet wide, it contained pools of stagnant water, the banks were twenty and thirty feet high, and had to be cut down to allow passage of the artillery. Jackson,[5] in 1877, crossed on a bridge at Cabezon, five or six miles below the point at which Simpson crossed. In 1846, Lieutenant J. W. Abert[6] reached the Rio Puerco at a point west of Albuquerque, where the banks of the river were "10 or 12 feet high" and vertical. Further upstream he camped near a ruined town which he heard afterwards was called "Poblazon" and here the banks of the river were about thirty feet high. From his general description he reached the river above San Ignacio, which was occupied until 1911, and the abandoned town was San Fernando y Blas, of which only the faintest traces remained in 1909. From the foregoing account it seems that erosion had begun on the Rio Puerco in the 40's, and therefore about forty years before the time given by the oral statements of local residents.

The arroyo of Chaco Canyon, a tributary of San Juan River, is now twenty to thirty feet deep and 150 to 450 feet wide. Many of the tributary canyons, such as Mocking Bird Canyon, are yet undissected, although a falls that recedes each year

[2] Duce, J. T., "The effect of cattle on the erosion of canyon bottoms," SCIENCE, n. s., Vol. 47, pp. 450–452. 1918.

[3] Bryan, Kirk, "Erosion and sedimentation in the Papago Country, Arizona," U. S. Geol. Survey Bull., 730-B, p. 80, 1922.

[4] Simpson, J. H., "Journal of a Military Reconnaissance from Santa Fe, New Mexico, to the Navajo Country," etc.: p. 27, Philadelphia, 1852.

[5] Jackson, W. H., "Report on the ancient ruins examined in 1875 and 1877," Chap. II, "Ruins of the Chaco Canyon examined in 1877," U. S. Geol. and Geogr. Surveys Terr. (Hayden Survey) 10th Ann. Rept., p. 432, 1878.

[6] Abert, Lieutenant J. W., "Report of his examination of New Mexico in the years 1846–47," Ex. Doc. 41, 30th Congress, 1st sess., pp. 466–467, 1848; also printed as Sen. Ex. Doc., 23, pp. 50–51, 1848.

marks the head of the tributary arroyo which will eventually destroy the alluvial plains in these canyons. The arroyos have increased since the early expeditions to the canyon, as recognized by Dodge.[7]

According to Simpson,[8] the "Rio Chaco" had, at the time of his visit in August, 1849, a width of eight feet, and a depth of one and a half feet at his camp near Una Vida. It is evident that this description applies to the muddy water that was then flowing. No mention is made of a channel or arroyo, although Simpson described the steep walled arroyos of three other streams that were crossed on the way to Chaco Canyon.

Lieutenant C. C. Morrison[9] visited the canyon in 1875, but does not mention an arroyo. Oscar Loew[10] visited the ruins, but his description of the topography of the canyon is too vague to be of value.

William H. Jackson[11] visited and spent five days in Chaco Canyon in 1877. Five or six miles above Pueblo Pintado the arroyo was so shallow that the Navajos had formed "water pockets" (reservoirs) by obstructing the channel (p. 432). Near this ruin the arroyo was ten or twelve feet deep and dry (p. 433). Between the ruins known as Pueblo Pintado and Weji-Ge, the dry bed of the arroyo with its vertical banks almost entirely cut off communication from one side of the canyon to the other. Numerous small cottonwoods grew along the bank (p. 436). Near Una Vida he notes that the arroyo is dry, although Lieutenant Simpson had found running water in 1849. He explains that at the time of his visit (spring) floods are rare, but that Simpson was there in August when floods are more common (p. 437). At Pueblo del Arroyo the arroyo was sixteen feet deep and forty to sixty feet wide (p. 443 and Pl. LIX). Two hundred and fifty yards below there were shallow pools of water in the arroyo, and here Jackson camped. New grass, young willows and cottonwoods in the bed of the arroyo, whose vertical banks were used to confine their animals, extended for half a mile up and down stream (p. 446).

It is evident from this account that in 1877 an arroyo existed, but it was yet small, for at Pueblo del Arroyo, where the greatest dimensions are recorded, sixteen feet deep and sixty feet wide, the arroyo was thirty feet deep and two hundred to three hundred feet wide in 1924. Unfortunately, no one has described in detail conditions in Chaco Canyon previous to Jackson's trip in 1877, but the very vagueness of the earlier accounts may be taken as evidence that no such arroyo as Jackson saw existed.

Northern Arizona and Southern Utah

The evidence for the Navajo Country lying largely in northern Arizona has been reviewed and conditions summarized by Gregory,[12] based on his surveys of 1909, 1910, 1911 and 1913.

A lake in Bonito Canyon described by Simpson[13] in 1850 has disappeared, and the canyon now has an arroyo twenty to thirty feet deep. The lakes in Laguna Canyon, shown on the United States Geological Survey's Marsh Pass map, published in 1882, no longer exist and their floors are trenched.

In 1880 a perennial water body existed in Tyende Valley and as late as 1893 a road traversed this valley, crossing and recrossing the stream, which is now an arroyo twenty feet deep. In 1894 the alluvial floors of Walker Creek and Chinle Creek were cultivated by the Indians, but in 1913 Walker Creek flowed in an arroyo eighty feet deep and Chinle Creek in an arroyo one hundred feet deep. Since the Mormons colonized Tuba in 1870 the Moenkopi has entrenched itself fifteen to forty feet. As a result of reviewing this evidence and from all data gathered from local inhabitants, Gregory concludes that the trenching took place within twenty-five to thirty-five years of this work—that is, from 1880 on. The evidence brought forward by Gregory is reiterated by Reagan.[14]

[7] Dodge, R. E., "The formation of arroyos in adobe-filled valleys in the southwestern United States" (abstract), Brit. Assoc. Advanc. Sci. Rept., Vol. 79, pp. 531–532. 1910. Also, "Arroyo formation" (Abs.), *Amer. Geologist*, Vol. 29, p. 322, 1902.

[8] Simpson, J. H., "Journal of a Military Reconnaissance from Sante Fe, New Mexico, to the Navajo Country," etc., p. 37, Philadelphia, 1852.

[9] Morrison, Lieutenant C. C., "Notice of the Pueblo Pintado and of other ruins in the Chaco Canyon," U. S. Geol. and Geogr. Surveys west of 100th Mer. (Wheeler Survey) Vol. VII, p. 367, 1879. Abstract from Report of Chief Engrs., for 1876, Appendix JJ.

[10] Loew, Oscar, "Report on the ruins in New Mexico," U. S. Geogr. Surv. w. 100th Mer. (Wheeler), Vol. VII, pp. 341–342, 1879. Also, Ann. Rept. Chief of Engineers for 1875, appendix LL.

[11] Jackson, W. H., *op. cit.*, pp. 431–450.

[12] Gregory, H. E., "Geology of the Navajo Country—a reconnaissance of parts of Arizona, New Mexico and Utah," U. S. Geol. Survey Prof. Paper 93, pp. 130–131, 1917.

[13] Simpson, J. H., 31st Congr., 1st sess., Ex. Doc. 64, p. 110, 1850.

[14] Reagan, A. B., "Archeological notes on the Pine River valley, Colorado, and the Kayenta-Tuba region, Arizona," Kansas Acad. Sci. Trans. vol. 30, pp. 244–331, 394–420, 1921. "Recent changes in the plateau region," Science, n. s., Vol. 60, pp. 283–285, 1924. "Stream aggradation through irrigation," *Pan-Amer. Geologist*, vol. 42, pp. 335–344, 1924.

At Flagstaff, in a comparatively humid climate where twenty-four inches of rain a year allows the growth of a pine forest, the Rio de Flag, a small creek flowing through a grassy flood plain, has entrenched itself in an arroyo from ten to twenty feet deep. This change took place in 1890 to 1892, according to Douglass.[15]

According to data gathered by Davis,[16] at Kanab, Utah, the arroyo, which was sixty feet deep in 1903, was begun by a great flood on July 29, 1883, and largely completed by the high waters of 1884 and 1885.

According to Meinzer,[17] Meadow Creek, which flows north in Washington County from high mountains to the Escalante Desert, once furnished irrigation water for a small settlement at Hamblin in the well-known Mountain Meadow, but between 1857 and 1908 heavy floods cut a deep gully through the meadow and robbed it of most of its water supply. The water of the creek was then used for irrigation at a ranch farther downstream.

Williams[18] has described the recent deposits of silt in Montezuma Canyon, a tributary of San Juan River, in southeastern Utah. He says that according to local cattlemen, up to about twenty-five years ago, that is the year 1900, there was no definite stream channel in the canyon or its tributaries, but that then deep washes (arroyos) began to form and within three years had worked headward thirty miles in the canyon. These washes are ten to thirty feet deep. The recent date given by Williams for the formation of the washes must be in error, for in 1875 W. H. Jackson[19] made extensive journeys in the region and says:

> Every canyon and valley has its corresponding wash, worn perpendicularly down through the dry, easily eroded soil forming circuitous but excellent pathways. In some valleys where the drainage is considerable these washes frequently attain a depth of from 30 to 40 feet, and are impassable for miles.

Regarding Montezuma Canyon he states:

> A narrow but deep wash meandered from side to side containing a few scattered pools of stagnant water while dense thickets of oak brush thickly interwoven with vines rendered progress anything but pleasant.

SOUTHERN ARIZONA, SOUTHERN NEW MEXICO AND SONORA

In southern Arizona, Santa Cruz River has trenched its flood plain since the late 80's.[20] Thornber[21] also places the erosion of this channel and others in southern Arizona as since 1885 to 1890.

The valley of Rillito Creek, a tributary of Santa Cruz River that enters from the east a few miles north of Tucson, was, as recorded by Smith,[22] an unbroken forest of mesquite in 1858, when the first settlement was made. Between the trees was a good growth of grass and the river course was indefinite and lined by an almost continuous growth of cottonwood, ash, walnut and willow trees. These conditions continued until 1872, when the United States Army post was moved from Tucson to Fort Lowell on the Rillito largely because natural grass could be cut for hay. Thereafter the Rillito cut a wide channel from ten to fifteen feet deep. Pantano Wash, a tributary of Rillito Creek, did not have a great flood until 1881, and the present broad arroyo with vertical banks was not cut until the 90's. At the time of the first settlement on Tanque Verde Creek, another tributary of the Rillito, there was a stagnant pond 150 feet long and 30 feet deep which gave rise to the name. The present deep channel has cut into and has drained the pond since that time.

Arivaca Creek, a tributary of Santa Cruz River, was entrenched about ten feet below its flood plain in 1917, but when Lieutenant Michler[23] visited the

[15] Douglass, A. M., "Some aspects of the use of the annual rings of trees in climatic study," Smithsonian Ann. Rept. for 1922, p. 238, 1924, and personal communication.

[16] Davis, W. M., "An excursion to the plateau province of Utah and Arizona," Harvard Coll. Mus. Comp. Zool. Bull., Vol. 42, p. 11, 1903.

[17] Meinzer, O. E., "Ground water in Juab, Millard and Iron counties, Utah," U. S. Geol. Survey Water-Supply Paper 277, p. 152, 1911, and personal communication.

[18] Williams, George O., "Radium-bearing silts of southeastern Utah," *Engr. & Min. Journal-Press*, Vol. 119, pp. 201–202, Jan. 31, 1925.

[19] Jackson, W. H., "A notice of the ancient ruins in Arizona and Utah lying about the Rio San Juan," U. S. Geol. and Geogr. Survey Terr. Bull., Vol. II, No. 1, pp. 25–45, 1876.

[20] Spaulding, V. M., "Distribution and movements of desert plants," Carnegie Inst. Washington Pub. 113, p. 9, 1909; Huntington, Ellsworth, "The climatic factor," Carnegie Inst. Washington Pub. 192, pp. 33–34, 1914; Visher, S. S., "Climate and geology" (abst.), SCIENCE, n. s., Vol. 51, pp. 522–523, 1920; Bryan, Kirk, "Erosion and sedimentation in the Papago Country, Arizona," U. S. Geol. Survey Bull. 730, pp. 77–80, 1922.

[21] Thornber, J. J., "The grazing ranges of Arizona," Univ. Arizona Agr. Exper. Sta. Bull. 65, pp. 335–338, 1910.

[22] Smith, G. E. P., "Ground water supply and irrigation in the Rillito Valley," Univ. of Ariz. Agri. Exper. Sta. Bull. 64, pp. 98–99. 1910. Also, Amer. Soc. Civil Engr. Trans. Vol. 78, p. 227, 1915.

[23] Emory, W. H., "Report on United States and Mexican Boundary Survey," Vol. I, p. 119, 1857.

locality in 1855, there were springs among the tule (bulrushes), and when Major Ferguson[24] passed this way in 1863, there was a fine "cienega" or swamp, and near the old reduction works a "laguna" or pond. Thus, between my visit in 1917 and these visits in 1855 and 1863, the channel had been deepened and the flood plain drained.

The trench on San Pedro River was cut progressively headward between the years 1883, when the arroyo first formed at the mouth of the river, and 1892, when the head water fall cut through the boundaries of the Boquillas Grant 125 miles upstream.[25] The floor of the valley was originally covered by sacaton grass with groves of cottonwood, ash and willow. Since the arroyo was cut a great forest of mesquite has sprung up.

According to Olmstead,[26] the main street of Silver City, New Mexico, is a drainage channel that was originally two or three feet lower than the adjacent ground. In 1887 this channel began to deepen, bridges were built for crossing and a wooden drop was constructed to prevent further headward cutting. This drop was carried away in a flood about 1892 (?). [1896 according to Rich[27]] and erosion proceeded until, in 1917, the channel was over one hundred feet wide and thirty-seven feet deep. Numerous buildings have been carried away in the progress of this erosion.

The floor of the canyon of Blue River,[28] a mountain tributary of the Gila, was in 1885 covered with grama grass, hardwood trees and pine. The stream had many trout. In 1900 floods began to cut an ever-widening channel and active erosion was in full swing by 1906. In 1921 the bottom of the canyon was ruined for agriculture and pasturage. The forty-five ranches with three hundred inhabitants that existed in 1900 were decreased to twenty-one ranches and ninety-five people in 1921.

San Simon Creek, which enters the Gila near Solomonville, once flowed through uninterrupted meadows and flats from a point near Rodeo more than one hundred miles to its mouth. According to Olmstead,[29] settlers near Solomonsville, in 1883, excavated a small channel twenty feet wide and four feet deep to confine the flood water. Since that time a channel formed and progressed headward through the flats for sixty miles to the lower end of San Simon Cienaga. Above this point there is no definite channel, but the new channel of the creek downstream is ten to thirty feet deep and six hundred to eight hundred feet wide. Schwennesen[30] describes the drainage of the area and states that the channel has formed since the advent of American settlers. Carpenter and Bransford[31] make the same comment but also say that in large floods the channel is still overflowed.

Rich[32] has described in much detail the arroyos or channel trenches of the streams tributary to Gila River by way of the Mangas River, an ephemeral stream of large drainage area that heads in the Silver City quadrangle. The arroyos are still working headward, but Rich fixes the date of their beginning between 1881 and 1891.

While these changes were taking place Gila River, the master stream of southern Arizona, was undergoing more complex changes. In its upper reaches it entrenched itself in its flood plain much after the fashion of its tributaries, and below the mouth of Mangas River the channel is increasing in width by the erosion of its banks and is consequently destroying its former flood plain that is now valuable irrigated farm land. Between October, 1915, and September, 1916, 2,145 acres of this land were swept away in Safford Valley and the San Carlos Indian Reservation.[33] On that part of the Gila, from the mouth of Santa Cruz River to Yuma, the channel

[24] Ferguson, Major David, "Letter of the Secretary of War communicating copy of report of Major D. Ferguson on the country, its resources and the route between Tucson and Lobos Bay," 37th Congr. Special sess., Senate Ex. Doc. No. 1, pp. 1–22, 1863.

[25] Bryan, Kirk, and Smith, G. E. P., "Geology and water resources of the San Pedro Valley, Arizona," U. S. Geol. Survey Water-Supply Paper (in preparation). See also: Carpenter, E. J., and Bransford, W. S., "Soil survey of the Benson area, Arizona," U. S. Bureau of Soils Field Operations for 1921, pp. 248 and 252, 1924.

[26] Olmstead, F. H., "Report on flood control of the Gila River in Graham County, Arizona, Letter from the Secretary of the Interior transmitting," Sen. Doc. No. 436, 65th Congr., 3d sess., pp. 24–25, 1919.

[27] Rich, J. L., "Recent stream trenching in the semi-arid region of southwestern New Mexico, a result of removal of vegetative cover," *Amer. Jour. Sci.*, 4th ser., Vol. 32, p. 244, 1911.

[28] Leopold, Arno, "A plea for recognition of artificial works in forest erosion control policy," *Jour. Forestry*, Vol. 19, pp. 269–270. March, 1921.

[29] Olmstead, F. H., *Idem*, p. 79.

[30] Schwennesen, A. T., "Ground water in San Simon Valley, Arizona, and New Mexico," U. S. Geol. Survey Water-Supply Paper 425, pp. 5–6, 1917.

[31] Carpenter, E. J., and Bransford, W. S., "Soil survey of the San Simon area, Arizona," U. S. Bureau of Soils Field Operations for 1921, pp. 584 and 594, 1924.

[32] Rich, J. L., *op. cit.*, pp. 237–245, 1911. (Abstract) Assoc. Amer. Geogr. Ann., Vol. 1, p. 135, 1911.

[33] Olmstead, F. H., *Idem*, p. 10.

has been filling up. As collected by Ross[34] the accounts of early travelers and of early settlers indicate that the channel when first seen by white men was narrow with firm sloping banks eight to ten feet high that were lined by large cottonwood and willow trees. There was a considerable low water flow and fish were plentiful. Here beavers flourished and furnished lucrative business for the early American trappers. Since 1880 the old channel has been filled and the existing channel is a sandy waste from a quarter to a half mile wide, in marked contrast to the channel of former times.

The arroyo of Sonoita River in Sonora was cut during a flood on August 6, 1891.[35] As recorded by Meinzer,[36] Whitewater Draw, which drains the southern part of Sulphur Springs Valley and is a tributary of Yaqui River, lies in a narrow valley less than twenty-five feet deep, which decreases in depth upstream and disappears. In this valley is a freshly cut stream channel sixty feet wide and ten feet deep that in 1910 was cutting headward into a grassy meadow. "According to William Cowan, a pioneer ranchman, the entire channel north of the Mexican boundary has been cut since 1884."

CONCLUSION

Of the writers known to have considered the problem, Hough[37] alone has attempted to give a date for the whole area. He says that the process began with the active occupancy of the region by white men thirty years before the date of his address, or in 1875. However, the foregoing review of the existing evidence as to the date when trenching began in southwestern United States indicates that these changes were initiated at slightly different times in each stream and occupied a considerable period in their accomplishment. The change from aggradation and the building of flood plains to dissection and the formation of arroyos in many streams of southern Arizona can be confidently placed in the decade 1880 to 1890, although many tributary streams were not affected until the 90's and some are still undissected. The date in southern Utah, northern Arizona and southern Colorado is apparently earlier, and cutting probably began at some time after 1860. The evidence as to the Rio Puerco in north-central New Mexico is conflicting and needs review. The statements of the early explorers indicate that the arroyos were already well formed at the time of the American conquest in 1846 and 47.

Most of the writers[38] who have considered the question attribute the erosion of the arroyos to the introduction of livestock and the consequent decrease in the vegetative cover and the formation of trails. These changes promoted rapid run-off and increased the rate of erosion.

The possibility that erosion of the arroyos is caused by slight uplift with increased gradient of the streams has been generally rejected because erosion of equal magnitude affects streams of different drainage systems that flow in all possible directions. Uplift so nicely adjusted to the drainage pattern is inconceivable.

Huntington has suggested that a slight change of climate toward dryer conditions would decrease the vegetative cover, promote run-off and be equally effective in producing channel trenching. Gregory, Visher and Bryan have taken a favorable attitude toward this hypothesis and have brought forward supporting but not conclusive evidence.

Reagan has presented the interesting postulate that in northern Arizona the numerous prehistoric inhabitants built so many dams and diverting embankments in the smaller streams that floods were sufficiently retarded so that alluviation took place farther downstream. With the disappearance of these people their works fell into decay and erosion then began.

Dellenbaugh,[39] in a comment on Rich's paper, points out that years ago he saw arroyos in places where there were no cattle and never had been. He believes that the channels of main streams are lowered by sudden floods in which the tributary does not share. Thereafter the channel of the tributary cuts back by headwater erosion ("retrogrades") and the channels of the secondary tributaries are also cut back ("cross-cuts").

Whatever the merits of these several hypotheses, it is evident that an essential element in the problem is the exact date and rate of progress in the erosion of each channel. The material assembled in this paper, although valuable, is meager in detail and

[34] Ross, C. P., "The lower Gila region, Arizona—a geographic, geologic and hydrologic reconnaissance with a guide to desert watering places," U. S. Geol. Survey Water-Supply Paper 498, pp. 64–65, and pp. 94–95, 1923.

[35] Lumholtz, Carl, "New Trails in Mexico," pp. 178–180, 1912.

[36] Meinzer, O. E., and Kelton, F. C., "Geology and water resources of Sulphur Springs Valley, Arizona," U. S. Geol. Survey Water-Supply Paper 320, p. 28. 1913.

[37] Hough, Walter, "Pueblo environment," Amer. Assoc. Advanc. Sci. Proc., Vol. 55, pp. 447–454, 1906.

[38] Dodge, Rich. Olmstead, Duce, Williams, Thornber, Leopold, Hough and Smith, in the works cited.

[39] Dellenbaugh, F. S., "Cross-cutting and retrograding of stream beds," SCIENCE, n. s., Vol. 35, pp. 656–658, 1912.

lacking in exactness. Each author has gathered historical material as an incident to other work, but the problem is deserving of intensive and continued effort. The human interests involved are considerable, for in these areas of small population every meadow and every small area of good pasturage is important. The investigator is ever confronted with questions: Has the formation of arroyos been wholly adverse to man or productive of good? If desirable, can former conditions be restored? How can existing property, fields, buildings and even towns be best protected against encroachment of the ever-widening channels? A proper solution of the practical problem will rest on considerations based on our theory of the cause of this erosion. If overgrazing or other artificial factors are the cause, regulation and a few simple structures may restore the conditions of the past. If erosion is the result of climatic change, a swing in the climatic cycle may at some future time restore the alluvial floors of the valleys without human intervention. The present need is for more facts in order that one or another of the proposed theories may be established. With the date at which cutting began definitely fixed and the date of introduction of livestock also fixed, a much better judgment as to the influence of overgrazing can be made. These historical data must be gathered locally for the many individual streams, and it is hoped that the large group of scientists interested will collect and publish the facts.

KIRK BRYAN

U. S. GEOLOGICAL SURVEY

FRANCIS HENRY PARSONS

THE death of Francis Henry Parsons on July 25 at the age of seventy years removes one who had a lifelong interest in the advancement of science. Though he left no written contribution to scientific literature, his work as librarian successively of two scientific collections is of undoubted importance.

His fifty-two years of government service comprised work in the United States Coast and Geodetic Survey, the United States Naval Observatory, and the Library of Congress. While in the Coast Survey, 1873–1894, he was made chief of library and archives, and assembled, from the scattered field parties and vessels, a library of from 12,000 to 15,000 volumes which is especially valuable for its source-material.

As assistant in charge of the Smithsonian Division of the Library of Congress, 1900–1925, he augmented the collection of transactions of learned societies and academies already gathered there, until, at the time of his retirement, it comprised 450,000 volumes. The significance of the collection is not, however, in the number of volumes, but in the nature of the material to be found there, which is unequalled in this country, in resources for the research student.

While others will build upon this foundation and will make it more widely known, Mr. Parsons's years of earnest and constructive work will remain a contribution of permanent scientific value.

H. W. PIERSON

SCIENTIFIC EVENTS

THE FOURTH INTERNATIONAL PHYTOGEOGRAPHIC EXCURSION

IN 1908, at the International Geographic Congress in Geneva, A. G. Tansley, of England, proposed that the plant geographers and other interested botanists should get together for an extended field trip. The British vegetation committee, which was approached with the proposition, favored it. They made plans to receive the visiting botanists and in 1911 conducted them through England, Scotland and Wales on what was officially called the "First International Phytogeographic Excursion" (I. P. E.).

The second excursion was held in the United States in 1913. Then came the war and the third was not held till 1923. A neutral country, Switzerland, was chosen as the field.

The fourth International Phytogeographic Excursion was held this past summer from July 2 to August 24 in Sweden and Norway. The excursion began in Lund (South Sweden) on July 2 and continued northeasterly for eight days toward Stockholm. On July 10 began the excursion through Middle and North Sweden. In Middle Sweden interest centered upon the vegetation of the Archipelago off Stockholm, the coniferous forests and the moors. The scientific institutions in Stockholm and Uppsala were also visited and the places associated with the work and life of Linnaeus.

The route from here lay northward to Abisko (Lat. 68° N.), where five days were spent at this most northerly station in Sweden. At this point commenced the Norwegian section of the trip which lasted for three weeks and ended on August 22 in Oslo. On this date the party left for Sweden and after two days spent in and around Gothenburg, adjourned for the summer on August 24.

The Swedish botanists were hosts for the excursion and under their able secretary, G. Einar Du Rietz, should be congratulated on the efficiency with which the excursion was conducted. The Swedes set an example as guides and hosts which other nations must find hard to equal.

Twenty-eight botanists representing the following 15 countries (exclusive of Sweden) were present for all or a part of the excursion:

Australia	1	Ireland	1
Austria	1	Japan	1
Czecho-Slovakia	2	Latvia	1
England	1	Lithuania	1
Finland	2	Poland	2
France	1	Russia	2
Germany	4	Switzerland	7
United States	1		

ORAN RABER
UNIVERSITY OF ARIZONA

A COOPERATIVE COURSE IN ELECTRICAL ENGINEERING AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

WITH the opening of the fall term, the Massachusetts Institute of Technology took another step in carrying out its policy of maintaining the closest possible contact with the industries of the country. Arrangements have been completed with the Bell Telephone System by which a limited number of students in electrical engineering will be given an opportunity to get thorough first-hand knowledge of the manufacture, operation and development of the most modern electrical systems of communication including wire and wireless telephony and telegraphy.

By this new arrangement, a carefully selected group of students who have successfully completed the first two years of the regular course in electrical engineering at the institute, or the equivalent at other institutions, will be sent to New York. For four months they will be under the direction of the Bell Telephone System. During part of this time they will be put to work in the Western Electric Company's plant at Kearney, N. J., learning the actual details in the manufacture of telephone appliances. The remainder of the time will be spent in the work of installing and conditioning telephone switchboards in the vicinity of New York City.

During this time the students are on the pay roll of the Bell System and must turn out their day's work like other workmen, but as fast as they master one job they are transferred to another. The new course requires these students to attend regular institute classes while they are on the practical assignment and since they can not come to the institute, the institute goes to them by maintaining an instructing staff in New York. The class hours will be in the evening in order not to interfere with the practical work. The subject matter will be almost equally divided between electrical theory, and such cultural subjects as the writing and delivering of technical papers and reports and study of contemporary English literature and drama.

At the end of the four months this group of students returns to the Massachusetts Institute of Technology in time to join their schoolmates in starting the second term's work, and another group takes their place in New York. They will spend the alternate terms at the institute and on the job in New York City where they will complete their practical experience by doing actual telephone operating in the various plants of the New York Telephone Company and getting familiar with the technical and practical problems of maintaining plant and equipment.

A final cooperative period will be spent in the Bell Telephone Laboratories carrying on research and studying the design and development of engineering processes and apparatus for both wire and radio systems.

Because of the advanced nature of the instruction and the research work of the last year, the higher degree of master of science in electrical engineering as well as that of bachelor of science is conferred upon those who successfully complete the course. Students are subject to the usual requirements applying to the employees of the cooperating company. The compensation paid by the company to students in this cooperative course, exclusive of the allowance for expenses incidental to changes in residence, amounts approximately to a total payment of fifteen hundred dollars during the cooperative periods. The working week ranges between thirty-nine and forty-eight hours depending on the character of the work assigned.

NEW HALL OF REPTILE AND AMPHIBIAN LIFE AT THE AMERICAN MUSEUM OF NATURAL HISTORY

EARLY in the coming year a new hall of reptile and amphibian life will be opened at The American Museum of Natural History, occupying the entire third floor of the east wing, according to *Museum News*.

Here for the first time the groups prepared under the direction of the late Mary C. Dickerson—groups characterized by the curator of the department, G. Kingsley Noble, as "perhaps the finest series of reptile and amphibian habitat groups ever produced"—will be seen unconfused with an incongruous overflow from the Hall of Mammals; and with them will be shown a whole series of new groups.

An effort has been made to arrange the material within the hall so that the various types of visitors may readily discover what interests them without wearying themselves in fruitless staring at what does not. The synoptic series of models and the systematic and "biological diagrams" illustrating principles or facts of importance to the technical student are to be found in the main body of the hall. In a cloister

along the west wall are arranged the fascinating series of habitat groups, many of them shown for the first time. The series of local reptiles and amphibians, of great interest to school children and amateur naturalists, is installed in an alcove at the far end of the hall.

Among the artistic and strikingly life-like groups to be seen through the windows of the cloister may be mentioned the Galapagos Island group depicting the life of land and sea iguanas, material for which was secured by William Beebe; the Florida cypress swamp, largest and last of the groups built under Miss Dickerson's supervision; the Sphenodon group; the giant tree frogs, and the new Gila monster group in a setting of cactus-strewn Arizona desert.

AWARDS FROM THE MILTON FUND AT HARVARD UNIVERSITY

ANNOUNCEMENT has been made at Harvard University of the second series of awards in accordance with the provisions of the Milton Fund for Research. Allotments are made at present for not more than two years, and twenty-seven awards are made at this time, amounting to something over $41,000 for 1925–1926 and $15,500 for 1926–27.

The Milton legacy yields an annual income of about $50,000. A committee was appointed to advise the corporation in making a selection among the investigations proposed by members of the instructing, scientific or administrative staff of the university. The committee has consisted of Frank B. Jewett, electrical engineer, of New York, *chairman;* Professor Edwin F. Gay, of the department of economics at Harvard, and Professor W. J. V. Osterhout, formerly of the department of botany at Harvard.

The awards include the following to members of the scientific faculty:

Earnest Albert Hooton, assistant professor of anthropology; for the purchase of a machine, recently developed in the psychological laboratory of Princeton, for calculating coefficients of correlation in research in the anthropological laboratory.

Harlow Shapley, Paine professor of practical astronomy and director of the Harvard College Observatory; to purchase apparatus providing automatic temperature controls and comparison spectrum accessories for two stellar spectographs at the observatory.

Gregory Paul Baxter, Theodore William Richards professor of chemistry; for two years, for research connected with the determination of atomic weights through the density and compressibilities of gases. Results obtained with oxygen and helium have proved very valuable, and it is hoped that in the immediate future the studies may include experiments on hydrogen, nitrogen and some of the rare gases.

George Shannon Forbes, associate professor of chemistry; for supplies used in a research connected with the oxidation potentials in liquid ammonia.

Grinnell Jones, associate professor of chemistry; to purchase apparatus and supplies for an electrochemical investigation of the properties of solutions of salts.

Walter Fenno Dearborn, professor of education; to allow him to devote himself to the supervision of the major research enterprise of the Graduate School of Education: "an investigation of the mental and physical development of school children by means of annually repeated measurements of several thousands of the same individuals from the time of their entrance into school to the time of the completion of their formal education."

Comfort Avery Adams, Abbott and James Lawrence professor of engineering; for research having for its objective the better understanding of the mechanism of the dielectric phenomena in solid dielectrics.

Albert Sauveur, Gordon McKay professor of metallurgy; to allow him to prosecute with greater speed and efficiency his metallurgical investigations, including the corrosion of iron and steel, the influence of casting conditions on the physical properties of iron and steel, and grain size of pure metals.

George Vibert Douglas, instructor in geology, to purchase a quartz spectrograph for determining the minor constituents of minerals, ores and rocks, and the composition of minute mineral grains too small to be analyzed in other ways.

Percy Williams Bridgman, professor of physics; for expenses in connection with his high pressure investigations.

Edwin Crawford Kemble, assistant professor of physics; to defray the expense of experimental investigation of the influence of a magnetic field on band spectra.

Richard Clarke Cabot, professor of clinical medicine and professor of social ethics; for two years, for a study, desired by the department of social ethics, of the results of the treatment of delinquents in Massachusetts.

William John Crozier, associate professor of general physiology; to conduct research to determine the physicochemical nature of the central nervous activities.

Samuel Randall Detwiler, assistant professor of zoology; to assist his researches in the field of Experimental Neurology.

George Howard Parker, professor of zoology and director of the zoological laboratory; to assist his research study in the nerve transmission of Physalia.

Edward Charles Jeffrey, professor of plant morphology; to assist in his study of trees in Australia and New Zealand.

William McDougall, professor of psychology; to assist his research on the transmission of acquired characters.

Adelbert Fernald, instructor in orthodontia and curator of the dental museum; for two years, to assist in perfecting measuring instruments for ascertaining the natural development of normal bone growth in a child from birth to the twelfth or thirteenth year of age, so that a comparison of the normal average bone growth of a healthy child may be made with those which are abnormal.

SCIENTIFIC NOTES AND NEWS

DR. HARVEY CUSHING, professor of surgery at the Harvard Medical School, will give the Cameron Prize lectures at the University of Edinburgh during the week of October 18. His subjects are: "The third circulation," "The glandula pituitaria as we now know it and intracranial tumors and the surgeon." Previous awards have been made as follows: 1889, Pasteur; 1890, Sir Joseph Lister; 1891, Professor David Ferrier; 1893, Professor V. A. H. Horsley; 1895, Professor Behring; 1896, Professor Macewen; 1897, Professor Thomas R. Fraser; 1898, Dr. Sydney Monckton Copeman; 1899, Major David Bruce; 1900, W. M. Haffkene; 1901, Patrick Manson; 1902, Major Ronald Ross; 1904, Professor Niels R. Finsen; 1910, Professor August Bier; 1911, Dr. Simon Flexner; 1914, Professor Paul Ehrlich; 1915, Sir Lauder Brunton; 1920, Sir Robert Jones; 1921, J. J. B. V. Bordet; 1922, Professor F. G. Hopkins; 1923, Professor J. J. R. Macleod.

ARRANGEMENTS have been made between The Bayer Company, Inc., and the Crop Protection Institute whereby Professor C. R. Orton, on leave of absence from the Pennsylvania State College, will devote one half of his time during the year closing July 1, 1926, to fundamental studies in the field of seed borne parasites. These investigations will include studies on the life history of certain parasites, but especially the methods whereby such organisms overseason upon or within seeds and the action of disinfectants upon them. The investigation will be carried out at The Boyce Thompson Institute for Plant Research at Yonkers, New York, and the work will be under the direction of a special committee consisting of Dr. William Crocker, director of the institute; Professor M. T. Munn, of the New York Agricultural Experiment Station, Geneva, and Professor W. L. Burlison, of the University of Illinois.

DR. MAURICE C. HALL has been promoted to the position of chief of the zoological division of the Bureau of Animal Industry, to fill the vacancy caused by the death of Dr. Brayton Howard Ransom.

DR. GILBERT H. CADY, head of the department of geology of the University of Arkansas, has been appointed senior geologist in charge of coal studies on the Illinois Geological Survey, to succeed Dr. H. E. Culver, who has accepted the headship of the department of geology at Washington State College, Pullman. Dr. Cady's appointment becomes effective on January 1, 1926.

A LUNCHEON in honor of Professor Alexander Findlay, of the University of Aberdeen, Scotland, was recently held in the Harvard Club, Boston. Professor Lyman C. Newell, of Boston University, presided, and speeches were made by Theodore W. Richards, head of the department of chemistry at Harvard University, and Dean Henry P. Talbot, for many years head of the department of chemistry at the Massachusetts Institute of Technology. Professor Findlay addressed the northeastern section of the American Chemical Society in the evening at the Massachusetts Institute of Technology.

CAPTAIN ROALD AMUNDSEN, the explorer, now lecturing in the United States, has been awarded the Livingstone gold medal of the Royal Scottish Geographical Society, the highest award of the society, for his services to geographical exploration.

SIR ARBUTHNOT LANE has been appointed an honorary member of the Belgian Académie Royale de Médecine at Brussels.

A GOLD medal was recently presented by his friends and pupils to Professor R. Colella, of the chair of nervous and mental diseases at Palermo. He has recently published in a volume of 1,000 pages a compilation of the works that have issued from his service.

DR. RICHARD WILLSTÄTTER, formerly professor of chemistry at Munich, has been awarded by the Zürich School of Technology an honorary doctorate of science.

PROFESSOR EUGEN GOLDSTEIN, formerly physicist at the Berlin Observatory, recently celebrated his seventy-fifth birthday.

C. WHITMAN CROSS and William H. Dall, senior geologists; John H. Renshaw, maker of shaded relief maps for the topographic branch, and George M. Wood, editor, all of the U. S. Geological Survey, retired from active service on July 1 on account of age.

DR. ALGERNON COOLIDGE, professor of laryngology at the Harvard Medical School, has resigned and will be made professor emeritus.

PROFESSOR F. J. MOORE, professor of organic chemistry at the Massachusetts Institute of Technology, has retired from active teaching but will continue his research work.

DR. FELIX LÖHNIS, head of the division of soil bacteriology of the United States Department of Agriculture for the past thirteen years, is returning to Germany to resume his former position at the University of Leipzig.

DR. JOHN E. ANDERSON, formerly of Yale University, has taken up his work as director of the Institute of Child Welfare of the University of Minnesota, recently established under a grant of $250,000 from the Laura Spelman Rockefeller Memorial.

DR. FRANCIS HARPER, instructor in zoology at Cor-

nell University, has been appointed assistant curator of animals and fish in the Boston Museum of Natural History.

DR. CLARK WISSLER, professor of anthropology in the Yale Institute of Psychology, will leave soon for Hawaii and Australasia to visit scientific institutions and familiarize himself with the progress of anthropological research in those countries. He will be accompanied by Edwin R. Embree, of the Rockefeller Foundation.

DR. A. HRDLIČKA, who has spent the larger part of this year on a trip to India, Ceylon, Java, Australia and South Africa in the interest of researches on man's antiquity and evolution, has returned to Washington.

PAUL G. HOWES, curator of natural history at the Bruce Museum of Greenwich, Conn., will leave in December for a collecting trip on the Isle of Dominica. It is planned to establish a permanent laboratory and base for the exploration of the Leeward Islands.

DR. ERNST PRIBRAM, professor of general and experimental pathology in the University of Vienna, has arrived in the United States to spend a year at the Milwaukee Hospital studying cancer.

PROFESSOR OTTO RAHN, chemist and dairy specialist of the faculty of the University of Kiel, Germany, is giving a series of lectures at the Massachusetts Agricultural College on subjects relating to the dairy industry.

DR. BASIL GRAVES, London, is giving three courses of two weeks each in slit lamp microscopy of the eye at the New York University and Bellevue Hospital Medical College.

DR. FRANK BILLINGS laid the cornerstone of the Albert Billings Memorial Hospital at the University of Chicago on October 3. Dr. Max Mason, president of the university, presided at the ceremonies, and Dr. Henry A. Christian, professor of medicine in the Harvard University Medical School, delivered an address.

DR. LEWELLYS F. BARKER, of the Johns Hopkins University, delivered the Wesley M. Carpenter lecture at the New York Academy of Medicine on October 15, on "The management of neurotic patients."

DR. JOHN H. GIBBON, professor of surgery at Jefferson Medical College, will give the annual "ether day" address at the Massachusetts General Hospital on October 16.

DR. E. H. VOLWILER, of the Abbott Laboratories, Chicago, will address the Chicago section of the American Chemical Society on October 23, on "Some applications of chemistry to medicine." Dr. Volwiler is retiring chairman of the section.

PROFESSOR E. H. BARTON, professor of physics in University College, Nottingham, England, died on September 23 at sixty-six years of age.

SIR WILLIAM SCHLICH, late inspector-general of forests in India and professor of forestry at the University of Oxford, died on September 28 at the age of eighty-five years.

PROFESSOR CHARLES VÉLAIN, the first occupant of the chair of physical geography in the faculty of sciences of the University of Paris and founder of the *Revue annuelle de Géographie*, recently died, aged eighty years.

PROFESSOR F. RANWEZ, professor of pharmaceutical chemistry in the University of Louvain and president of the International Congress of Pharmacy held at Brussels in 1897, has died, aged fifty-nine years.

DR. ERNST VON HAMMER, professor of geodesy and astronomy at the School of Technology at Stuttgart, has died, aged sixty-seven years.

THE regular monthly meeting of the American Section of the Society of Chemical Industry will be held on October 16, when Professor Bradley Stoughton, of the department of metallurgy, Lehigh University, will present a paper entitled "Light structural alloys," and Professor D. D. Jackson, of the department of chemical engineering, Columbia University, will present a report of the recently held annual meeting of the Society of Chemical Industry in England.

THE annual meeting of the American Psychological Association, of which Dr. Madison Bentley, professor of psychology at the University of Illinois, is president, will be held in Ithaca during the Christmas holidays.

THE Harvard College Observatory will be open to the public from 7:30 P.M. to 9 P.M. on the dates given below. A short non-technical talk will be preceded, when the weather permits, by telescopic observation of celestial objects. Exhibits showing the work of the observatory will be explained by members of the staff. Tickets for the open nights must be obtained in advance by writing to the Harvard College Observatory. October 16—"The milky way," Professor Bailey; October 26—"The major planets," Professor L. A. Brigham, of Boston University; November 12—"Stellar evolution," Dr. Payne; November 24—"The star clouds of Magellan," Professor Shapley; December 9—"Variable stars," Professor S. D. Townley, of Stanford University.

HERBERT HOOVER, secretary of commerce, has announced that the fourth national radio conference will

be held at Washington, beginning on November 9. The conference is called for general discussion and consideration of matters affecting radio communication in the United States from the viewpoint of the public interest. The conference will include representatives of all interested commercially in any degree in radio activities. Representation will be accorded also to the Institute of Radio Engineers, the American Institute of Electrical Engineers, the National Electric Light Association and other bodies.

THE University of North Carolina, the oldest state university in the country, will celebrate on October 12 the semi-centennial of the reopening of the institution following the civil war. In the afternoon the dedication of the new chemistry building, recently completed at a cost of $400,000, will take place. Dr. P. P. Claxton, former United States commissioner of education, will deliver the principal address.

THE executive committee of the American Medical Library Association is making an investigation of the present high cost of German medical publications. It is hoped to determine whether or not concerted action on the part of medical libraries of America will cause German publishers to reduce the cost of their publications. In order to obtain some joint action in the matter, those willing to aid in the movement are asked to communicate with Miss Margaret Brinton, librarian, Mayo Clinic, Rochester, Minn.

A PARTY of sixteen French engineers have arrived in this country, where they will conduct a six weeks' investigation of American power-plant practice.

AN international institute at Rome for the study and cure of malaria has been proposed at the International Anti-Malaria Congress in session there. The Italian government has promised support.

A NEW department of geophysics has been established by St. Louis University, to investigate problems relating to the dynamics of earth and its atmosphere.

THE Bufalini Prize of 6,000 lire is offered for the best work presented on the subject of the necessity of the experimental method in study of all the sciences—as opposed to a speculative and dogmatic philosophy—with a review of what this method has contributed to special sciences during the twenty years since the last awarding of the prize. The competing articles must be in Italian or Latin, with the name in a sealed envelope, and be received before July 30, 1926, addressed to the Segreteria della R. Universita, Piazza S. Marco, Florence.

ACCORDING to the Prague correspondent of the *Journal* of the American Medical Association, the chamber of deputies has passed the bill creating the institute of hygiene in Prague, by joint action of the Czecho-Slovak government and the International Health Board of the Rockefeller Foundation. The institute, which will be under the ministry of health, will make investigations for the public health service, foster education in preventive medicine and take care of the education of the health personnel. The government may create branches of the institute in provincial cities, especially where there are medical faculties. The ministry of health will create a special advisory council to the institute of hygiene. It was pointed out to the parliament that a modern health organization needs the closest contact with scientific investigators in preventive medicine. The opposition, including the communists, voted for the bill, which passed the house of deputies unanimously. The bill will come before the senate in September, and there is no doubt that it will be accepted without any material change. The date for the official opening of the institute has been set for the end of September.

UNIVERSITY AND EDUCATIONAL NOTES

ANNOUNCEMENT has been made that residents of Baltimore have contributed half of the $1,500,000 which is being sought as this city's share of the $10,890,000 fund for development of the Johns Hopkins University and the Johns Hopkins Hospital.

TEXAS TECHNOLOGICAL COLLEGE, at Lubbock, a state institution with an initial appropriation of $1,000,000 for buildings, opened its doors formally with 742 students on October 1. Its program includes arts and sciences, engineering, agriculture and home economics. During the first year only freshmen and sophomores are admitted, the junior and senior courses to be added in 1926. Among the faculty are included the following: A. H. Leidigh, dean, W. L. Stangel and C. H. Mahoney in agriculture; R. A. Studhalter in biology; W. T. Read, W. L. Ray and F. D. Galbraith in chemistry; Wm. J. Miller, dean, and E. W. Camp in engineering; L. T. Patton in geology; Miss Margaret Weeks, dean, Miss Johnnie McCrery and Miss Dorothy McFarlane in home economics; J. N. Michie, D. A. Flanders, W. M. Whyburn and Miss Elizabeth S. Stafford in mathematics, and E. F. George and C. S. Mast in physics.

THE two new positions of assistant professor of epidemiology and assistant professor of industrial hygiene in medicine have recently been filled in the Institute of Public Health of the School of Medicine of Columbia University. Dr. Alton S. Pope, on completion of studies on scarlet fever carried out chiefly at Providence, R. I., under the guidance of Dr. Charles V. Chapin, has assumed the duties of assistant professor of epidemiology; Dr. Frank G. Pedley,

having resigned as physician at the Cheney Silk Mills at South Manchester, Conn., is the new assistant professor of industrial hygiene now engaged in the development of an occupational disease class at the Vanderbilt Clinic.

AT the University of Pennsylvania the following promotions are announced in the mathematics department: Dr. M. J. Babb from assistant professor to professor; Dr. J. D. Eshleman from instructor to assistant professor, and N. E. Rutt from assistant to instructor. New appointments are: Dr. P. A. Caris, assistant professor; W. A. Bristol, instructor; H. M. Lufkin, instructor, and M. Brooks and L. Zippin, assistants.

AT Yale University Dr. William Clark Trow, associate professor of educational psychology at the University of Cincinnati, has been appointed visiting professor of educational psychology; Edward A. Bott, associate professor of psychology in the University of Toronto, visiting associate professor of psychology, and Dr. Barnett Fred Dodge, formerly of the Massachusetts Institute of Technology, assistant professor of chemical engineering.

DR. HAROLD HIBBERT, professor of industrial chemistry at Yale University, has been appointed to the professorship of cellulose chemistry at McGill University, Montreal.

DR. L. R. CLEVELAND, National Research Council fellow in zoology at the Johns Hopkins University, has been appointed assistant professor of protozoology in the department of tropical medicine at the Harvard Medical School.

DR. HARLEY E. FRENCH, formerly professor of anatomy and dean of the school of medicine of the University of North Dakota, has been appointed assistant professor of anatomy in the University of Pennsylvania School of Medicine.

DR. ALEXANDER LOW, reader in embryology, attached to the anatomy department, Aberdeen University, has been appointed Regius Professor of Anatomy in that university in place of Professor Reid, resigned.

DISCUSSION AND CORRESPONDENCE

TRYPARSAMIDE

A RECENT issue of SCIENCE (September 18, 1925, lxii, 251) contained an article by Professor Chauncey D. Leake, of the University of Wisconsin, in which he relates the history of a cooperative organization composed of members of the faculties of the University of Wisconsin and Northwestern University and others associated with them. Referring to the achievements of this organization, Professor Leake mentions (page 255) "the finding that tryparsamide . . . is of great value in the treatment of syphilis of the central nervous system" as "the most important achievement of this cooperative research which has been published to date." He prefaces his account of this achievement by saying that it "has been heralded as the greatest advance in the therapy of syphilis since Ehrlich introduced salvarsan." In recounting "the steps leading up to this discovery" Professor Leake makes the unqualified statement that "Ehrlich's preparations (arsphenamine and neo-arsphenamine) are of no value in neuro-syphilis" and he makes it appear that the "finding" referred to above was the result of chance studies of drugs that "had been discarded for use in general types of syphilitic infections" based on certain theoretical conceptions of Professor Loevenhart and Professor Lorenz and refers to tryparsamide specifically as "among such substances."

For the benefit of the readers of SCIENCE, it should be pointed out that the statements made by Professor Leake concerning the importance of tryparsamide and the value of the arsphenamines in neuro-syphilis are not representative of current medical opinion; furthermore, his version of the events leading to the discovery of the therapeutic value of tryparsamide in neuro-syphilis is a novel one and does not agree at all with the brief but clear statement given in the first four paragraphs of the paper by Lorenz, Loevenhart and their associates[1] or with the more detailed account given by Brown and Pearce,[2] who studied the action of tryparsamide in animals and conducted the preliminary clinical investigations which formed the basis of its application to neuro-syphilis as stated by Lorenz, Loevenhart, Bleckwenn and Hodges.

There are few, if any, syphilologists who would subscribe to Professor Leake's statement concerning the lack of value of the arsphenamines in neuro-syphilis. On the contrary, these drugs are generally regarded as the most effective therapeutic agents that are available for the treatment of most forms of neuro-syphilis and as of some value in all forms of the disease.

Tryparsamide is still used less extensively than the arsphenamines and its usefulness in neuro-syphilis appears to be more restricted. In the present state of our knowledge, no final judgment of its value can be made, but the consensus of opinion among those who have investigated this subject is that tryparsamide is of great value in properly selected cases and

[1] Lorenz, W. F., Loevenhart, A. S., Bleckwenn, W. J., and Hodges, F. J., *J. A. M. A.*, 1923, May 26, lxxx, No. 21, 1497–1502.

[2] Brown, Wade H., and Pearce, Louise, *J. A. M. A.*, 1924, Jan. 5, lxxxii, 5–9.

even now it occupies an important position among the remedies that are available for the treatment of neuro-syphilis. Professor Leake's enthusiastic estimate of its value may be prophetic but can not be accepted as an accomplished fact.

Finally, there is some doubt as to whether one would be justified in referring to the results of the clinical investigations carried out at the University of Wisconsin as an "achievement of this cooperative research." All the work on which the application of tryparsamide to the treatment of neuro-syphilis was based was done by an independent group of workers; the study of tryparsamide by Lorenz, Loevenhart and their associates was not in any sense a chance study of "arsenical compounds which had been discarded for use in the general types of syphilitic infection," but this study was undertaken in response to a specific suggestion based on the results of laboratory and preliminary clinical investigations. The connection of the Wisconsin group of workers with the development of tryparsamide was, therefore, essentially the same as that of Alt and other clinicians with the development of salvarsan in that they were given the opportunity of carrying out one phase of the clinical investigations necessary to the determination of the probable therapeutic value of tryparsamide.

WADE H. BROWN

ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

IMMUNITY TO TUBERCULOSIS BY THE INJECTION OF EXTRACT OF HEART MUSCLE

THE article by Professor Elliott C. Prentiss in the issue of SCIENCE for July 31 prompts me to make a brief report of some experimental work undertaken a goodly number of years ago, but for various extraneous reasons never carried to completion. In my work as pathologist to the Philadelphia General Hospital and to the University Hospital, I was struck by the rarity, in fact, the virtual non-occurrence, of tuberculosis of the heart muscle. This seemed to me to have but one of two explanations: (a) that the activity of the intracardiac circulation was such that the tubercle bacillus had no chance to lodge; (b) that the immunity of the myocardium was due to a biologic property, to some antituberculous substance in the muscle. Assuming that the latter was the more probable reason, I undertook a series of experiments in which I made extracts of beef's heart and mixed the filtrate obtained with virulent tubercle bacilli and injected the suspension into guinea pigs. In this work I had the help of Dr. Karl F. Meyer, now of California. It seemed to me that the material had a distinct inhibitory influence. Unfortunately, Dr. Meyer left Philadelphia for his new field, while my own work in clinical medicine and teaching came to absorb nearly all my time. I have proposed a repetition of the experiments to several men whose facilities and opportunities for research of this character were greater than my own, but so far no one has begun to work actively upon the problem.

If the immunity of the heart muscle and of the skeletal muscles is, as I believe, biological rather than mechanical, then it may be possible to extract an active agent by suitable means. In my own experiments pieces of heart muscle were cut up into small fragments under aseptic conditions and the fragments put into a grinding machine with china balls. The juice was then pressed out under great pressure and finally filtered through a Berkefeld filter. The filtrate, a golden colored liquid, was then used for the experiments. It is highly probable that the procedure could now be greatly simplified.

DAVID RIESMAN

UNIVERSITY OF PENNSYLVANIA

A COMBINED CULTURE MEDIUM AND INDICATOR FOR PARAMOECIUM

IN the April 10, 1925, issue of SCIENCE, Bragg and Hulpieu describe the effect of a stain obtained from red cabbage leaves as an indicator of the acidity of the food vacuoles of Paramoecium. I have been unable to secure similar satisfactory results with the races I am using, but have found that a dilute infusion of red cabbage leaves (about 30 grams to one liter of water) is an excellent medium in which the animals not only reproduce rapidly but at the same time the color of the infusion indicates the chemical condition of the culture. When fresh, the cabbage leaf culture medium is light reddish purple in color, but about twenty-four hours after being seeded with Paramoecium, it turns red, indicating the formation of acid. In four or five days to two weeks, as the paramecia increase in number, the medium gradually becomes alkaline, as is shown by its change of color to green.

The culture, as far as quantity of paramecia is concerned, is at its height when it becomes a brilliant green and has lost its early turbidity. The behavior of the cultures can be varied considerably by adding a trace of sodium bicarbonate or a weak acid. In from one to two months, the culture becomes the color of an old hay infusion, fails to react to acids or alkalies and the paramecia have either wholly or almost wholly died off.

ROBERT T. HANCE

ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

AN UNUSUAL METEOR

WHILE riding in the fields about two miles east of Wolf, Wyoming, post office, on August 20, we observed a very interesting and unusual meteor. It entered the atmosphere about northwest of the point of observation, and about 60° above the horizon. Its illuminated path was perhaps seven degrees when it disappeared without reaching the earth. After the brilliant ball of light had disappeared an illuminated spiral remained and continued stationary in the sky for at least five minutes. This spiral was about one and a half turns and extended for about three degrees. The effect was much like a fiery serpent, the head being a ball more brilliant than the rest of the spiral, and the last part to disappear. The light from the meteor proper was the usual white, and almost sufficient to cast a shadow. It probably would have cast a shadow if it had been later in the evening (time 7:30 P.M., mountain time). The spiral was at first a light orange and very distinct in the twilight sky and gradually changed to a red, perhaps a little lighter than cherry, when it gradually disappeared. The spiral remained distinct for at least five minutes.

JAMES J. KLINE

FORT WAYNE, INDIANA

SCIENTIFIC BOOKS

Food Products. By HENRY C. SHERMAN, Ph.D., Sc.D., professor of food chemistry, Columbia University. Second Edition Revised and Enlarged.

THIS valuable contribution to the knowledge of our foods has been rewritten in view of the great progress made in the knowledge of nutrition during the past ten years. In his preface he says:

> In order to put the user of the book in touch with recent advances in all phases of knowledge of food products without making the descriptive text unduly voluminous, many of the publications of the past ten years which are chiefly significant as extending our descriptive knowledge or as developing certain topics more fully than is feasible in a book of this size, are included by title in the lists of references at the ends of the chapters, so that by selection from these the teacher may develop the course, or the individual reader may extend his reading, as fully and in such direction as may be desired in each case.

As a result of this principle the references are inclusive and contain citations to all literature which any one wishing to secure further information may need to consult. This feature of the book is extremely valuable.

The book is descriptively chemical. It, however, is not written for the chemist alone but for the general reader as well. It particularly contains most valuable information which will be extremely helpful to the housewife in all her problems connected with the feeding of her family. As food is the most insistent need of humanity it should receive first consideration at the hands of those interested in human welfare and particularly the women who direct the domestic affairs in this country. It is a book, therefore, that can be read by every intelligent person and with great advantage to those who are seeking further knowledge as to the character of our foods and what they do to us.

I will not take time to describe the book in detail, but will mention only those important features which appeal to me as being of the greatest interest and value. First of all, of course, the housewife will read the articles on milk and its products. Butter is not considered in this article, but has first place in the chapters on edible oils. As milk is the most important of our foods, I want to call particular attention to the fine way in which the subject is presented and to the stress that is laid upon its importance in our dietary.

The feature which is most striking to me is the description of the use of sour milk, which is so palatable and has such wonderful helpful effects in many of the diseases of the digestive system. The new lactic acid ferment, bacillus acidophilous, is described, and the methods by which it does its work is set out in detail. The use of milk sugar in connection with the milk soured by the above ferment is explained in detail, and some hope is offered to those who wish to change to a certain extent the bacterial flora of the lower intestinal digestive organs. The importance of adding milk to bread, taking the place of water in the dough, is properly stressed. The importance of sanitation in the milk supply is duly pointed out.

The article on butter is full of valuable information. The progress in the manufacture of butter has resulted in the gradual increase of water in butter in the last few years, and particularly since the advent of the creamery. A few years ago the average content of butter fat in butter in 221 samples from fifty-five creameries in different parts of Iowa was 84 per cent. and the average content of moisture 12.73 per cent. In 1902 the United States Department of Agriculture analyzed eight hundred samples of butter from four hundred creameries in eighteen states, and the average of all the samples in moisture was 11.78 per cent. Gradually, under the insistent demands of the creameries, the standard for butter fat has been finally reduced to 80 per cent., a loss of 4 per cent. in the course of twenty or twenty-five years.

There is one feature of butter manufacture, however, that Sherman fails to mention. At the present time at least 75 per cent. of the creameries of the United States use what is known as the neutralizing process of making butter. This "neutralizing" is euphemistic for treating cream, which is so far decayed as to be unfit, in such a way as to make it usable. Neutralizing consists in adding some kind of alkali, usually lime, to reduce the acidity and thus make cream workable which otherwise would be unfit for manufacture.

In addition to this, under the influence of the creameries the Congress of the United States has passed a bill in which the moisture requirement of not to exceed 16 per cent. has been abolished, so that it is possible to make butter now legally which contains no salt and yet may contain almost or quite 19 per cent. of moisture. Thus, it is seen that one feature of progress in butter-making has really been a progress in selling more water and less butter to the consumer. This is not good for the reputation of the dairy industry and is a fraud on the consumer. Inasmuch as economy is almost as important in our food supply as purity and excellence, this omission is regrettable.

Sherman stresses the point that cereal grains are, as far as economy is concerned, the most important factors in our food supply. He dwells at length on the damage done to our grains by the milling process and touches briefly upon the additional factor of bleaching an already much too white product. He quotes the old data issued many years ago by the Department of Agriculture as to the higher digestibility of white flour as compared with whole wheat flour. These data show that the digestibility of protein in standard patent flour is 88.6 and in graham flour 79.4 per cent. As regards the starch or carbohydrate element, the digestibility of standard patent flour is 97.7 per cent. and of graham flour 89.2 per cent.

In another part of the book, however, he calls attention to the fact that recent work indicates that the difference in digestibility between properly prepared whole wheat bread and that made from patent flour is less than formerly supposed. He says:

> Probably for much the same reasons that they are more efficient in nutrition, whole wheat products when not properly kept are more susceptible to the ravages of insects and microorganisms than is patent flour, so that the latter can much more readily be kept for long periods without special care. This is a practical point of considerable importance but should not be over-emphasized, for the marketing of whole grain products is a large and apparently growing industry. It now appears that the difference in completeness of digestion is much more than compensated by the superiority of the whole wheat product in its mineral and vitamin content and in the nature of its proteins. In the amount of protein actually absorbed from the digestive tract, and in energy value, the difference between equal weights of whole wheat and patent flours is practically negligible. But a bushel of grain will make more pounds of the actual, or even of the so-called, whole wheat flour than of patent flour, so that, even from the standpoint of protein and energy, the best economy demands the milling of as high a percentage as seems practicable of the whole wheat kernel into human food, and from the vitamin standpoint this is also true and in much more striking degree.

Further on, Sherman pays his respects to the very common practice of those who are promoting the white flour industry in referring to those who, like Sherman, believe in the whole wheat industry, as "faddists," in the following language:

> Some writers and teachers treat the losses incurred in the ordinary milling processes as a matter of indifference or even object to any serious discussion of the problem, calling it a "fad" on the ground that with the mixed dietary prevalent in the United States there is no danger of "deficiency disease" from any mode of milling the grains. This is probably true as regards the pronounced diseases such as beriberi, but it is also true that many American family dietaries show little margin of safety as regards iron, phosphorus and calcium, which makes it only reasonable that we should wish to include in the products used for human food as much as is practicable of those parts of the grain which are rich in these elements.

Sherman calls attention to the fact that the body probably absorbs from a pound of genuine whole wheat bread at least twice as much phosphorus, iron and calcium compounds as from a pound of white bread. He also calls attention to the experiments with rats Bunge made as long ago as 1898. The rats receiving the whole wheat bread grew much better than those fed on white bread and were found to contain at the end of the experiment both a larger number of red corpuscles and a higher percentage of hemoglobin.

He need not have gone so far afield for an illustration, as only a few years ago the scientists in the Public Health Service made a very striking experiment in feeding fowls on whole wheat and white flour bread. Fowls are much more sensitive to beriberi than rats. In thirty-five days all the fowls that were fed white flour had died of or were suffering from beriberi, while those that had been eating whole wheat bread were apparently in perfect health and vigor and were growing normally.

The vitamins of cereals reside chiefly in the germ, while the minerals reside chiefly in the bran; thus, both bran and germ, in the proportions in which they

exist naturally in cereals, should be conserved for economic and health purposes in the preparation of human food. In this way, the cheapest foods will give their maximum of nutrition and health while with the use of milk or leaf vegetables they will also be for all except infants a complete food. The importance of these observations by Sherman is particularly pertinent at the present time. There is a very large percentage of our people who, on account of financial straits, are unable to buy as much milk and as many vegetables, particularly the leaf vegetables, as are required to properly supplement the use of refined cereals. The well-to-do may succeed in this endeavor without feeling the financial burden, but not so those with limited incomes. It is immensely important to this class of our people that the cereal foods which they use should be as nature intended them.

The very worthy endeavor among many of the bakers at the present time to use milk instead of water in the making of the dough should receive wide support. Sherman says in this matter that when milk constitutes one third of the total solids of the food intake, almost equally good growth results, whether the remainder of the diet is whole wheat or patent flour. Even when patent flour is replaced by starch, very good nutritive results follow. When, however, the proportion of milk decreases to one sixth of the total dry weight of food, the superiority of whole wheat to patent flour and patent flour to starch both become strikingly apparent. It is not at all likely, therefore, that the bakers will be able to provide a sufficient quantity of milk to constitute one third of the total solids of the food intake.

The author occasionally makes an error in his discussion. This is notably shown in his remark on sweetened condensed milk. He assumes that condensed milk is always regarded by the food authorities as sweetened condensed milk. This is a mistake. Condensed milk, as he quotes it on page 135, is a synonym for evaporated milk or concentrated milk. If he had looked a little further along he would have found a discussion in the government standards for sweetened condensed milk, and this would have avoided the comment which he made at the foot of page 135 in assuming that the condensed milk that he was discussing was the sweetened variety. The sweetened condensed milk is one which is largely used in this country for infant feeding and with very unsatisfactory results. To feed an infant a food which has a percentage of added sugar as high as ordinary preserves is little less than a crime against infancy. Particularly also it should be remembered that sweetened condensed milk is not sterilized and that, for this reason, it may contain very undesirable bacterial flora. There is no assurance even that the milk from which sweetened condensed milk is prepared is from tuberculin-tested cows. The author is somewhat in error, I think, in assuming that greater care is exercised in securing the raw material from which sweetened condensed milk is made than is exercised for the ordinary evaporated milks of commerce.

The author in discussing the ice-cream standards seems to take the side of the manufacturers rather than the consumer. In this he doubtless followed the recommendation of the committee on milk standards who adopted a very low standard, which was asked for by the ice-cream manufacturers without considering properly the rights of the consumers. The standard adopted by the committee appointed under authority of Congress to make standards for the guidance of the officials of the Department of Agriculture and for the information of the courts set the minimum requirements for ordinary ice cream at 14 per cent. and when flavored with fruits at 12 per cent.

In commenting on the federal standard the author says that it would make ice cream a fat rich food which many health authorities do not deem desirable, and adds that some authorities hold that since it is largely consumed between meals or at the end of a meal already sufficiently abundant, it should better remain as custom has so largely made it, a frozen beverage rather than a fat, rich food. I never have heard these sentiments expressed by any authorities other than those who were promoting the interests of the manufacturer in securing a low percentage of fat. I have never heard health authorities object to butter, although it is a much more concentrated fat food than ice cream. In point of fact, the author has inadvertently fallen into a plea for the lowest grade of so-called ice cream that the manufacturers wish to produce. Those who are familiar with the genesis of the food law all recognize that it was largely "common practices," such as the debasement of articles of diet, that the food law was intended to prevent.

In discussing the function of sugar in diet, the author very properly points out the danger which attends the enormous increase in its consumption in this country. It seems to me, nevertheless, that he does not quite properly point out its nutritive functions. On page 509 he says that the cheapening of this article of food by improvements in manufacture would be a source of great satisfaction but for the fact that refined sugar constituted an extreme case of a one-sided food, its sole nutritive function being to serve as fuel. I think, on the other hand, it is a very widespread feeling among students of nutrition that sugar has another function of almost equal significance, namely, that it is largely a source of fat. Not only, therefore, does the increase in refined sugar, as

the author says, make the diet deficient in some of the substances which are needed for the building and repair of body tissue, but also it has a tendency to produce an unnecessary and burdensome degree of fat.

The author quite naturally falls into a grave error in discussing the legal status of certain sweetening agents and so-called chemical preservatives. He properly recognizes the fact that those clauses of the food law which forbid the addition of poisonous or other added deleterious ingredients which may render such article injurious to health have given rise to more discussion than any other part of the law. It has done a great deal more than this. This discussion has led to an entire subversion of the purpose of the food law as enacted by Congress and to the practical elimination of the Bureau of Chemistry from passing judgment upon such added poisonous or other added deleterious ingredients. The author's discussion on this point is based upon a misunderstanding of the situation. On page 46 he makes the statement that the preservation of food by the so-called non-condimental preservatives is necessary. This is entirely erroneous. There is not a single article of food which contains an added preservative which can not be satisfactorily and perfectly manufactured without any addition of preservative at all. In point of fact, although under the wrongful interpretation of the statute to which I have just alluded certain preservatives are permitted, the number of manufacturers availing themselves of this privilege is extremely small. All the manufactured articles to which preservatives have been added are distinctly inferior in character and quality to those which are made without preservatives. Therefore, there is no justification whatever for this statement, which I quote verbatim:

> It is true that by drying, by heating and canning, and to a certain extent by refrigeration, foods may be preserved from the season of abundance to the season of scarcity without the addition of any preservative substance, but restriction to these methods of preservation would often be unnecessarily burdensome and costly and would in many cases involve a loss of the flavor for which the food is chiefly prized. The prohibition of all preservative substances would be as unsatisfactory to the consumer as to the producer and has never been seriously contemplated.

It is a matter of great regret that a book so full of excellent statements and so useful in the household as "Food Products" should convey so misleading and unwarranted a statement. I never yet have found any consumer who had requested that his foods be artificially preserved with non-condimental preservatives.

The purpose of the Referee Board of Consulting Scientific Experts, on which the author bases these statements, was not for the protection of the consumer at all. It was openly and devotedly a body which served as experts for the lowest grade of manufacturers in the country. Nearly $300,000 of money which was appropriated by Congress to secure the enforcement of the pure food law were diverted to pay the expense of this body of men working solely in the interest of food adulterators. Due regard for the eminent scientists who composed the board requires the statement that they were wholly innocent of any such purpose. They were asked to do scientific investigation. They learned afterwards the interests they were unwittingly serving. This board was investigated by the committee on expenditures in the Department of Agriculture during the months of July and August of 1911. The committee unanimously reached the decision that there was no warrant in law for the appointment of this board. It was merely a body appointed to advise the secretary of agriculture in certain matters over which he had no control. The law placed the investigation of these matters in the hands of the Bureau of Chemistry for the purpose of determining whether or not in any given case a food was adulterated or misbranded. In all but one instance the referee board of consulting scientific experts reversed the decisions of the Bureau of Chemistry, the organization which by law was authorized to make these decisions. The findings of this board were adopted by the secretary of agriculture in plain violation of the law.

The committee reported the curious circumstance of a board appointed as the personal advisors of the secretary of agriculture overthrowing the conclusions of the legalized body under the law and thus protecting food adulteration instead of eliminating it. Had I been permitted to enforce the law as Congress passed it there would not to-day be a single article of food in this wide country of ours that contained any non-condimental preservative of any description.

In addition to this, this body of consulting scientific experts authorized the use of alum in foods. Unfortunately, all these violations of the law are still in force, and the Bureau of Chemistry is to-day partly paralyzed in any effort to protect the foods of this country against any added deleterious or poisonous substance permitted by its decisions. Thus, one of the greatest purposes of the food law has been completely subverted. If our manufacturers were inclined to do so there is no reason why we should not have the worst adulterated foods of any country in the world. It is due to the high public spirit and honesty of the American food manufacturers that we have been saved from such a disaster.

H. W. WILEY

SPECIAL ARTICLES

ON THE CONFIGURATIONAL RELATIONSHIP BETWEEN β-OXYBUTYRIC AND LACTIC ACID

IT was shown in a previous communication[1] that levorotatory β-oxybutyric acid is configurationally related to levorotatory propylene glycol. That is, the asymmetric carbon atoms in these two substances have the same configuration when they rotate polarized light in the same direction. Independently of us and simultaneously this fact was ascertained by P. Karrer and W. Klarer.[2] We now find that lactic acid also can be converted into propylene glycol by the reduction of ethyl lactate with metallic sodium and alcohol. The glycol obtained in this manner rotates in the same direction as the original free lactic acid. Here again, in the glycol and in the lactic acid the asymmetric carbon atoms have the identical configuration when the acid and the glycol rotate in the same direction.

Therefore, a lactic acid and a β-oxybutyric acid are configurationally related when both are convertible into the identical glycol. In the present experiment, the starting material was lactic acid of low optical activity $[\alpha]_D^{20} = +0.7°$. The ester had a specific rotation of $[\alpha]_D^{20} = -2.5°$. The glycol had a rotation of $[\alpha]_D^{20} = +0.6°$. Its composition was C = 47.72%; H = 10.66%, the theory requires C = 47.37%; H = 10.52%.

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VARIATION IN GROWTH OF NURSERY GRAFTS

THE variable growth of apple grafts in the nursery is commonly ascribed to such causes as variation in the seedling stocks, incompatibility of stock and scion and poorly made grafts. While working upon the latter problem, it is believed that the principal cause of the extreme variation in growth has been found. The explanation to be offered developed from three observations: (1) The growth of the scion is usually made from the top bud; (2) the callus union is best along the tongues of the graft; and (3) the rapid rise of water during transpiration is in a straight line with very slow lateral diffusion. It is suggested then that, in order to secure the best condition for good growth, *the top bud of the scion should be directly above the point of union.*

More than 1,500 grafts of the 1925 planting were examined in early June to determine the relation of growth to bud position. The growth condition was recorded as bud dead, poor (only a few leaves forced out), medium (a few inches long but growth stopped), and good (actively growing at the time of observation). The bud positions were described by number as follows:

(1) Above matched side of tongues;
(2) Above lower lip of scion;
(3) Above mismatched side of tongues (opposite 1); and
(4) Above upper lip of stock (opposite 2).

Grafts made with the scion and root of equal size permitting a more extensive callus union had 6 per cent. more good, 19 per cent. more medium, and 25 per cent. less dead and poor growths than grafts with the scion and root of unequal size. The following data were secured from 907 of the latter grafts:

	Percentage
Position 1 (343)	91.9 good
	.3 dead
	2.3 poor
Position 2 (141)	9.9 good
	9.9 dead
	61.8 poor
Position 3 (182)	0.0 good
	7.8 dead
	88.9 poor
Position 4 (241)	4.6 good
	21.2 dead
	63.8 poor

In the case of equal-sized parts of the graft, approximately one third of the buds in positions 2 and 4 were making a good growth. There was a corresponding reduction in dead and poor growths. Of all dead buds observed, 78.8 per cent. were on position 4 where the direct ascent of moisture is often cut off.

Clearly, the position of the bud in relation to the point of union would seem to be the principal cause of the great variation in the early season growth of the grafts. Fortunately, only a slight reduction in the speed with which grafts are made will permit of all grafts being put together with the top bud of the scion directly above the matched tongues (position 1).

In addition to the practical significance of this finding, there is also the following item of technical importance: By eliminating the great variation in growth of the grafts due to the position of the bud on the scion, it will be possible to measure more accurately than has been done heretofore the interrelations of stock and scion.

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[1] *Journ. Biol. Chem.* (1925), lxv, 49.
[2] *Helv. Chim. Acta* (1925), viii, 393.